Comparison of Medical Subject Headings and standard terminology regarding performance of diagnostic tests*

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INTRODUCTION

Many useful methodological contributions regarding diagnostic tests have been published in biomedical journals in the past five years. For example, the Standards for Reporting of Diagnostic Accuracy (STARD) Steering Group proposed a standard for reporting studies of diagnostic accuracy [1], and Sackett and Haynes proposed a logical framework to categorize diagnostic research [2]. These recent advances, however, have not addressed issues related to terminology. For instance, some ambiguities occur, when terms of validity [3] or accuracy [4] are used in the same journal to cover similar concepts. These recent developments and ambiguities could be sources of difficulties for researchers and librarians seeking relevant literature on diagnostic tests.

In this brief communication, the authors review and define key concepts used by researchers when developing or assessing the performance of diagnostic tests. The authors then describe current terminology used in Medical Subject Headings (MeSH) and discuss implications for users and producers of information on diagnostic tests.

ASSESSING THE PERFORMANCE OF DIAGNOSTIC TESTS

Performance of a diagnostic test should be judged on two dimensions: its ability to measure what it is supposed to measure (i.e., the presence or absence of the disease to be diagnosed) and its ability to provide similar results, whatever the conditions of application or interpretation [5]. The ability of the diagnostic test to actually measure what a tester thinks it is measuring is usually called the ''criterion'' or ''predictive validity'' of the test [5]. It can be also defined as the ability to appropriately reflect variability in the phenomenon of interest. Authors have also used ''diagnostic utility'' as a synonym for validity [6]. In recent standards [1] and methodological discussions [7], the term ''accuracy'' has been recommended. Assessment of validity or accuracy consists in comparing results of a new diagnostic test to that of a gold-standard test, allowing estimation of the ''sensitivity'' (the proportion of subjects with the disease who have a positive test) and ''specificity'' (the proportion of subjects without the disease who have a negative test) or other parameters of performance of the test, such as likelihood ratios [8] and predictive values [9].

The ability of the diagnostic test to yield similar results, whatever the conditions of application or interpretation is called the ''reliability'' of the test [5]. It is also often referred to as the ''reproducibility'' of the test [10] or ''repeatability'' [11], because part of its assessment implies repeatedly applying the test to the same subjects. Reproducibility of results often depends on sources of variability external to the test, such as associated diseases or characteristics of the individual who applies or interprets the test. The latter is usually referred to as ''inter-observer'' reliability [5]. Assessment of reproducibility consists in comparing results of repeated applications or interpretations of the same test, allowing estimation of coefficients of

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Table 1
Links between concepts related to diagnostic performance, research terminology, and current Medical Subject Heading (MeSH) terms

Terminology	Source [reference]	MeSH term equivalents*
Validity	Textbooks [5]	Reproducibility of results
Accuracy	Standard [1]	None
Diagnostic utility	Used by some authors	None
Sensitivity and specificity	Standard [1]	Sensitivity and specificity Diagnostic errors ■ False negative reactions ■ False positive reactions
Observer	Textbooks [5]	■ Observer variation
Reliability	Textbooks [5]	Reproducibility of results Diagnostic errors ■ Observer variation
Reproducibility	Textbooks [5]	Reproducibility of results Diagnostic errors ■ Observer variation ■ Intra-observer variation
Repeatability	Used by some authors	None
Inter-observer reliability	Textbooks [5]	Observer variation
Agreement	Textbooks [5]	None
Homogeneity	Textbooks [5]	None

* Bulleted entries are not MeSH terms but appear under more general terms.

''agreement,'' such as Cohen's kappa [12] or the intraclass correlation coefficient [5].

Whenever the diagnostic test is a complex scale, such as a questionnaire including several items or dimensions, lack of reliability can be related to the way items or dimensions are correlated. In such instances, assessing reliability of the diagnostic test usually consists in estimating the ''homogeneity'' of the scale, the way results of all items tend to agree [5]. Examples of coefficients of homogeneity are Kuder-Richardson 20 and Cronbach's α [13].

SEARCHING MEDLINE TO RETRIEVE DIAGNOSTIC PERFORMANCE STUDIES

When searching the MeSH vocabulary, ''Diagnosis'' appears both as a MeSH term and a subheading of MeSH terms indicating diseases. Diagnosis is also a preset strategy in PubMed Clinical Queries. Standard terminology and MeSH have good or acceptable agreement for three concepts (Table 1):

1. ''Sensitivity'' and ''Specificity'' are logically grouped in a single MeSH term, ''Sensitivity and Specificity,'' and ''Specificity'' is a preset term searched in titles and abstracts when using PubMed Clinical Queries.
2. The first suggested MeSH term for reliability is ''Reproducibility of Results.''
3. The user is referred to ''Observer Variation'' for observer; the definition includes both inter-observer reliability and repeatability, although the latter is referred to as the entry term ''Intra-observer Variation.''

Other available MeSH terms related to diagnosis are problematic, either because they have a different definition than that given in standard textbooks [5] or because some key concepts are not covered. The important term with a different definition is validity, for which the first suggested MeSH term is ''Reproducibility of Results.'' The latter's definition is compatible with standard definitions of reliability but not of validity [5].

Key elements relevant to validity and reliability are also mixed up under another MeSH term, ''Diagnostic Errors.'' Indeed, ''Diagnostic Errors'' covers the MeSH terms ''False Negative Reactions,'' ''False Positive Reactions,'' and ''Observer Variation.'' Both false negative and false positive reactions are relevant to the assessment of validity—the proportion of false negative reactions is the complement to one of sensitivity, and the proportion of false positive reactions is the complement to one of specificity, whereas observer variation, as seen above, is relevant to the assessment of reliability. Finally, words with no MeSH equivalents are diagnostic utility, accuracy, repeatability, agreement, and homogeneity.

IMPLICATIONS

Familiarity with diagnostic concepts and related terminology varies from one discipline to another. For instance, biologists are mainly dealing with one-item diagnostic tests, such as dosages, even when they are technologically sophisticated [14]. Psychologists are more familiar with complex tests where homogeneity becomes an issue [15]. Nevertheless, both validity and reliability are important concepts to judge the performance of all types of diagnostic tests [5].

Our discussion of key concepts related to performance of diagnostic tests has practical implications for indexers, users, and developers. Indexers of a diagnostic study will find it important to specify whether the study is of validity (''sensitivity and specificity'') or reliability (''reproducibility''). Librarians and researchers will need to search MEDLINE both with existing MeSH terms and text words with other terms used to define relevant concepts.

Finally, the authors suggest that further developments of MeSH should consider separating validity

and reliability and create terms such as ''accuracy,'' which is now accepted as a standard synonym for validity [1], and ''homogeneity,'' which is needed to characterize many studies on reliability. Other terms or phrases could also be added to the Entry Terms list in the MeSH database as synonym terms entries.

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Plants from many healing landscapes: gathering information and teaching clinicians about the cultural use of medicinal herbs*†

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BACKGROUND

The increasingly diverse US immigrant populations, the growing use of medicinal herbs, and the necessity for training in cultural competence have created a need for related educational opportunities for health care professionals. To address these concerns, the Boston Healing Landscape Project (BHLP), together with the Center for Complementary and Alternative Pharmacotherapy of the Massachusetts College of Pharmacy and Health Sciences and the Treadwell Library of the Massachusetts General Hospital, offered a postgraduate education program, ''Cultural Use of Herbs in Latino and Haitian Communities—Herbal Tour.'' Table 1 provides an outline of the program. This article discusses the challenges involved in creating one of four lectures given during the program, ''The Pharmacology of Latino and Haitian Herbs.''

A closer look at the rationale for this project focuses on the following trends. Use of herbal supplements in the United States continues to grow. This practice is widespread and extends across the lifespan. Patients with chronic conditions are among the heaviest users, as they constantly search for additional ways to relieve the symptoms of their diseases. Clinicians need information on these preparations, including evidence of efficacy, adverse effects, toxicities, and interactions with drugs, laboratory tests, and surgical procedures [1, 2].

Research indicates that herb use does not change with relocation and more advanced education, challenging the conventional clinician to learn about these

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Table 1
Postgraduate course program: ''Cultural Uses of Herbs in the Latino and Haitian Communities—Herbal Tour'' (April 3, 2004)

Topic	Presenter	Main points addressed
''Traditional Healing Systems of Cuban Santeria and Haitian Vodou''	Linda Barnes	Complementary and alternative medicine (CAM) versus folk/ethnic concepts; evidence-based medicine; holistic cross-cultural understanding; cultural and ritual significance of herbs
''Health Conditions and Herbal Use in Haitian Communities''	Riché Zamor	Health conditions in Haiti; common uses of herbs; immigrants' use of herbs in United States
''Pharmacology of Latino and Haitian Herbs''	Julie Whelan and Lana Dvorkin	Historical use, scientific use, toxicities, ingredients of commonly used herbs; information resources
''The Multiple Meanings of Efficacy''	Linda Barnes	Cross-cultural understanding of efficacy; establishing effective therapeutic alliance
Haitian botánica	Erol Josué, Vodou priest	Medicinal and ritual use of herbs in Haiti
Mother Nature Cuban Botánica	Steve Quintana, santero	Traditional healing system of Cuban Santeria; diagnostic process of divination

therapies [3, 4]. Several reasons for this phenomenon are:

- Knowledge of herbs is a source of pride and identity, as herbs are perceived by patients as ''our own medicines.''
- Herbal use is part of cultural tradition, passed down through generations.
- Herbs are relatively inexpensive.
- In many cultures, herbal medicines are used with biomedicine in a complementary rather than alternative approach [5–7].

Today's health care professionals must become ''culturally competent'' as they care for an increasingly diverse immigrant population [8] and issues of health disparities receive attention. This cultural competence mandate comes from the US Department of Health and Human Services [9], the Institute of Medicine [10], and professional organizations such as the American Medical Association [11, 12] and the American Nurses Association [13]. As practitioners become culturally aware, they communicate more effectively with their patients, discover previously hidden problems, and consequently provide better care [14]. Efforts to create educational programs and information resources to address these trends are underway [15, 16].

Medical librarians can play an important role in supplying clinicians with the information they need to care for diverse patient populations. Librarians can integrate information on traditional healing practices, especially the cultural use of herbs, into this endeavor. Finding such information is difficult and time consuming, because it is currently dispersed through the literature of many disciplines: medical anthropology, ethnobotany, pharmacognosy, sociology, medicine, theology, and others. When discussing topics of immigrant health, all of these fields of study contribute to a knowledgebase on ancestry and healing traditions. Only a few resources attempt this integration, so ample opportunity exists for research and collaboration by medical librarians, drug information pharmacists, public health workers, medical anthropologists, and other scholarly researchers.

METHODS

Gathering information from the above disciplines and converting it to a form that would be easily used by conventional medical practitioners involved many steps. The time-intensive preparation for the presentation, ''Pharmacology of Latino and Haitian Herbs,'' as well as the accompanying information for the BHLP Website, required numerous visits to several libraries and help with translation and assistance from the healers in the community. Table 2 gives an idea of the variety of references consulted.

Local healers were a source of information. Medical anthropologists and community members helped identify traditional healers in a given area. Collaboration with a medical anthropologist also shed light on the cultural context of herbal use such as the ritual and religious significance associated with the spiritual elements of their efficacy. Immigrant healers often substitute locally available herbs if they cannot obtain the plants used in their native countries [5, 7]. The local healers and medical anthropologists offered information on such local practices in herbal therapy. In their research, the authors found that traditional healers are often reluctant to discuss herbal use with people from outside their cultural group.

Community members used common names learned in their native language to identify herbal therapies. To obtain comprehensive information about one specific plant, however, its Latin botanical binomial name must be used. Finding and tracing this name as it evolved was probably the most difficult step in the process and often required help from numerous reference resources from different countries. The part of the plant used was another piece of the puzzle, and this information was rarely available. An additional complication was that many remedies contain more than one herb. Consulting the pharmacognosy literature yielded information on chemical structures, medicinal and pharmacologic activities, and limited toxicity data. Often this information was only available in the resources published in the plant's country of origin. Consequently, even when such a reference was available, a translator was necessary. Because the interactions data for even the most studied medicinal plants is primarily hypothetical [17], interaction information remained one of the most desired, yet least available pieces of information. Finally, phytotherapy texts provided information on the medicinal activities, toxicities, and interactions of the herbs.

Table 2
Sample of information sources

Sources	Notes
ALLEN R, CUSHMAN LF, MORRIS S, FELDMAN J, WADE C, MCMAHON D, MOSES M, KRONENBERG F. l. Use of complementary and alternative medicine among Dominican emergency department patients. Am J Emerg Med 2000 Jan;18(1):51–4.	This study provides a snapshot of complementary and alternative (CAM) remedies, especially herbs, used by Dominican patients in a New York City emergency room.
ARMSTRONG WP. The wild and wonderful world of gourds. [Web document]. Escondido, CA: Palomar University, 1996. [cited 26 Nov 2004]. <http://waynesword.palomar.edu/ww0503.htm>.	Gourds such as calabash and bottle gourd are commonly used medicinally in the Caribbean; pictures; authored by a botany professor.
BEAUVOIR MG. Of herbs and energies at the Temple of Yehwe. [Web document]. Plainview, NY: MG Beauvoir, 2003. [cited 20 Apr 2005]. <http://www.vodou.org>.	Describes Haitian healing practices including phytomedicinals; provides cultural context and multimedia.
DAVIDOW J. Infusions of healing: a treasury of Mexican-American herbal remedies. New York, NY: Fireside, 1999.	Lists herbs by name and indication; chart of Spanish, English, and botanical names; sources of additional information.
DESTEFANO A. Latino folk medicine: healing herbal remedies from ancient traditions. New York, NY: Ballantine, 2001.	Individual herbs, synonyms, history; written for general audience.
GERMOSÉN-ROBINEUR L, [ED.] Hacia una farmacopea caribeña: investigacion cientifica y uso popular de plantas medicinales en el Caribe. Santo Domingo, Republica Dominicana: Enda-Caribo, UAG & Universidad de Antioquia, 1995.	* An outstanding resource but hard to find; summarizes scientific studies; in Spanish; some monographs available online <http://www.funredes.org/tramil/espanol/>.
MORTON JF. Atlas of medicinal plants of Middle America: Bahamas to Yucatan. Springfield, IL: Charles C. Thomas, 1981.	* A major source; presents information in chart form; lists uses by country; references.
NewCrop Resource online database. [Web document]. West Lafayette, IN: Purdue University, 2004. [cited 21 Apr 2005]. <http://www.hort.purdue.edu/newcrop/default.html>.	Includes uses, folk medicine, chemistry, cultivation, distribution, ecology, references and the text of Morton's *Fruits of Warm Climates* <http://www.hort.purdue.edu/newcrop/morton/>.
OSOSKI AL, LOHR P, REIFF M, BALICK MJ, KRONENBERG F, FUGH-BERMAN A, O'CONNOR B. Ethnobotanical literature survey of medicinal plants in the Dominican Republic used for women's health conditions. J Ethnopharmacol 2002 Mar;79(3):285–98.	Helpful for herbs from Dominican Republic and Haiti.
PACHTER LM, CLOUTIER MM, BERNSTEIN BA. Ethnomedical (folk) remedies for childhood asthma in a mainland Puerto Rican community. Arch Pediatr Adolesc Med 1995 Sep;149(9):982–8.	Pachter studies traditional healing, including issues of cultural competence; an excellent author to follow in this subject area.
QUIROS MORAN D. Guide to Afro-Cuban herbalism. Bloomington, IN: 1st Books, 2003.	No index.
TAYLOR L. Tropical plant database. [Web document]. Carson City, NV: Raintree Nutrition, 2003. [cited 21 Apr 2005]. <http://www.rain-tree.com/plants.htm>.	Information on the ethnic uses of rainforest plants; while there is a commercial aspect to this Website, the author is a doctor of naturopathic medicine (ND), and the information is well referenced; has extensive, country-by-country information on the uses of the listed plants; provides links to other Internet sources: MEDLINE, USDA Plant Profiles, Dr. Duke's Database.
TORRES E. Curanderismo: Mexican folkmedicine and folk beliefs. Curanderismo y yerbas medicinales. [Web document]. Albuquerque, NM: University of New Mexico, 2004. [cited 12 Apr 2005]. <http://www.unm.edu/%7Echeo/%7Echeo/LONGCURAN.pdf>.	A professor at the University of New Mexico, Torres's presentation on the healing practice of *curanderismo*; includes photos; related Web pages describe the history of this type of Hispanic healing.
WENIGER B, ROUZIER M, DAGUILH R. Folk medicine in the central plateau of Haiti. II. ethnopharmacologic inventory. J Ethnopharmacol 1986;17(1):13–30.	An early survey of Haitian medicinal plants.
ZAMOR RC. The use of herbal remedies in two Haitian communities and implications for health-care providers worldwide. Lewiston, NY: Edwin Mellen Press, 2001.	A study of the medicinal herbs used by a native Haitian community and Haitian immigrants to Boston.

This table is a sample of important sources consulted in preparing the authors' presentation. The complete bibliography runs to eight pages so this is not a comprehensive listing. Keep in mind that medicinal plants travel from country to country as people emigrate and bring their healing practices with them. Suggested databases indexing the literature: EMBASE, International Pharmaceutical Abstracts, and MEDLINE (PubMed).

In creating the lecture, ''Pharmacology of Latino and Haitian Herbs,'' a medical librarian worked with a pharmacist. Both felt that discussing authoritative information sources was as important as presenting profiles of individual botanical remedies. Thirty-six health care professionals participated in the herbal tour. Continuing medical education (CME) and continuing education units (CEU) credits were awarded. Twelve evaluations were completed. Overall ratings for the pharmacology lecture content and for the presenters ranged from satisfactory to excellent. A majority of the participants felt that the presenters were able to achieve their objectives very effectively or effectively.

After the lectures, the participants took a field trip to two *botánicas. Botánicas* are specialty stores ''that sell medicinal herbs, religious amulets, and other products (e.g., incense, perfume) used for healing remedies'' [18]. Immigrant patients feel comfortable going to *botánicas* because they offer knowledgeable staff, a culturally sensitive environment, and no language barri-

er. In the *botánica,* patients do not need health insurance, prescriptions, or other documents. Medicinal agents can be purchased there in small amounts and at low cost [18].

After the herbal tour, ongoing work centers on developing herbal monographs for the BHLP <http://www.bmc.org/pediatrics/special/bhlp/pages/herbs/herbs.htm>. The herbs described are primarily used in Latino and Haitian cultures. Each monograph includes sections on traditional use and ritual or religious significance (if available), as well as mechanism of action, active ingredients, toxicities, scientifically proven medicinal properties, links to additional information, synonyms in relevant languages, references, and a photograph.

CONCLUSION

Haitian and Latino patients use medicinal herbs as part of their traditional healing. For this reason, health care providers need more in-depth education on these remedies and practices. Information related to these herbs is scattered and may be difficult to find. Continued research and funding of projects in this area are necessary to improve health care in these communities. This is an exciting area for medical librarians to contribute their research skills, teaching, and scholarship.

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